WAAS OPERATIONAL READINESS PLAN

1. INTRODUCTION

1.1. Background

The operational implementation of satellite navigation technologies into the NAS represents the most significant change the aviation community has faced in over 50 years. Satellite navigation technology presents unique challenges and offers the first opportunity to deploy a truly global NAVAID. The effort required to coordinate and standardize worldwide civil aviation operations is, alone, a significant one.

The numerous technical, operational, and organizational requirements that needed to be addressed for satellite navigation operational implementation dictated a transition period that began with the formation of the FAA's Satellite Operational Implementation Team (SOIT) in 1991 and is programmed to continue to the year 2010.

The operational implementation of satellite navigation technologies into the NAS will impact avionics certification, training, operational approvals, Air Traffic procedures, criteria development, flight inspection, ground and space-based augmentations, NOTAMs, and instrument approach procedure development.

The GPS Product Team (PT) is responsible for the development, research, and acquisition of safe, cost-effective, efficient satellite navigation systems in accordance with the Operational Requirement Documents (ORD) generated by the system sponsor (AVR-1). The SOIT is responsible for the operational implementation of satellite navigation systems technologies for aviation applications in the NAS, oceanic, and other worldwide operations. As the FAA's focal point for operational implementation, the SOIT provides guidance and direction to the GPS Product Team. The SOIT has directed that an evaluation of the operational readiness of the WAAS Phase 1 be completed by the SOIT WAAS Commissioning Working Group prior to Commissioning.

1.2 Purpose

The WAAS Operational Readiness Plan provides a means of assessing all the operational aspects of WAAS implementation prior to system Commissioning. The Plan presents the purpose, scope, objectives, resources required, and other pertinent information necessary to evaluate the operational readiness of the FAA's WAAS prior to its Commissioning on July 15, 1999.

The WAAS Operational Readiness Evaluation will, on a non-interference basis, be partially integrated into WAAS Operational Test and Evaluation (OT&E) conducted by the FAA Technical Center.

The purpose of this Plan is to facilitate the execution of the proposed WAAS Operational Readiness Evaluation. This Plan, when executed, will provide the senior FAA leadership with the additional technical and operational documentation required to declare the WAAS safe for use in the National Airspace System (NAS).

1.3 Scope

This Plan addresses the operational readiness of the WAAS. While the objective of the OT&E effort is to test the physical connectivity and technical performance of the WAAS in the NAS, the evaluation of the operational readiness of the WAAS will focus on the operational use of the WAAS Signal-In-Space (SIS) to provide safe en route, terminal, nonprecision, and precision approach service to NAS users.

2. SYSTEM DESCRIPTION

2.1 General

The Phase 1 WAAS is comprised of twenty-five Wide Area Reference Stations (WRS), two Wide Area Master Stations (WMS), a Terrestrial Communications Network (TCN), two Geostationary Earth Orbit (GEO) transponders, and four Ground Uplink Subsystems (GUS). Collection of observable data is performed primarily by the WRS sites throughout the country. The data collected by the WRSs is routed through the TCS to the WMSs. The WMSs determine the integrity, differential corrections, and residual errors for each monitored satellite and for each predetermined IGP. Messages from each WMS are formatted in accordance with the WAAS specification, sent to the GUS, and uplinked to the GEOs. The GEOs broadcast the WAAS messages to the users.

WRSs are located at twenty-five geographically dispersed data collection sites. Each data collection site has GPS/WAAS receivers that monitor signals from the GPS satellites and the WAAS messages broadcast by the GEO. These measurements are used to determine WAAS differential corrections. They also provide the feedback needed to monitor system integrity.

The WRS data is forwarded to all WMSs. These WMSs process the data to determine differential corrections, satellite and ionospheric integrity, and ionospheric delay information. Calculations are performed to determine GPS/WAAS accuracy, as well as verify the post-correction residual error bounds for each monitored satellite and each selected IGP in the specified service volume. The WMSs also format WAAS messages specific to each GEO satellite in service. The Geostationary Communications Subsystem (GCS) consists of a single

GEO satellite and two dedicated GUSs (primary and backup, each located at a different Ground Earth Station [GES]) that provide redundant uplinks to the GEO. The primary GUS transmits WAAS integrity, differential corrections, and ionospheric information, along with GEO satellite navigation data, superimposed on a GPS-like ranging signal, to aviation users via GEO satellites. The satellites broadcast the data on the GPS-transmitted L-band radio frequency, 1575.42 MHz (L1). Users of the system include all aircraft applying the WAAS data and the GEO ranging signal(s) for an approved phase of flight. The Phase 1 WAAS is expected to provide service for en route, terminal, nonprecision approach, and CAT I precision approach. The availability of CAT I precision approach during the WAAS Phase 1 will be operationally restricted.

2.2 WAAS Phase 1 Operational Concept and Implementation Strategy (Approach Phase of Flight)

2.2.1 Objectives

a. Provide vertical guidance on instrument approach procedures

b. Provide benefits to GPS and barometric-VNAV aircraft certified for approach procedures

c. Continue to provide benefit to TSO C129 equipped aircraft

d. To the extent practical, the operational concepts for ILS, WAAS, LAAS, and MLS should be consistent

e. Provide a reasonable availability for each level of service

f. Use the same obstacle clearance criteria for WAAS and LAAS as new ILS and MLS Category I precision approaches

2.2.2 Operational Concept

For each runway served, there will be an RNAV approach plate published. The RNAV approach plate will include a note: “GPS required”, meaning that the LNAV guidance must be based on GPS throughout the approach. This note may be removed if flight inspection, aircraft requirements, and operational implementation are defined for RNP approaches.

The approach plate will include three minima:

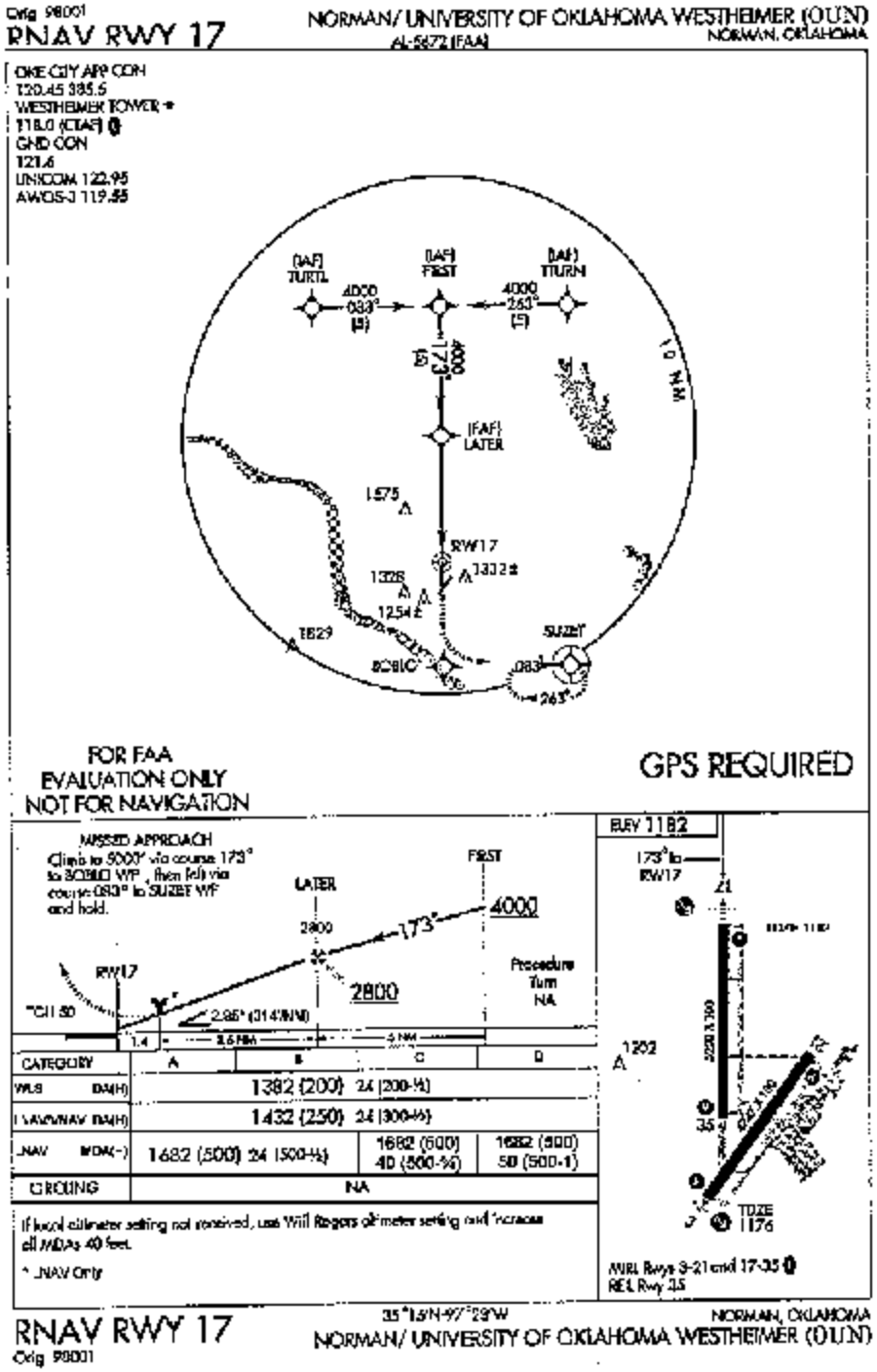
Table 2-1

Approach*	Type of Approach	Qualifying Aircraft	Obstacle Clearance Criteria
WAAS PA	WAAS Precision approach (lowest DA(H) = 200')	WAAS w/vertical	Order 8260.36 (same as new ILS/MLS)
LNAV/VNAV	Instrument procedure with vertical guidance (IPV) (lowest DA(H) = 250')	• WAAS w/ vertical (vertical may be degraded) • FMS based on GPS with barometric VNAV • WAAS NPA with barometric VNAV • GPS NPA with barometric VNAV	Order 8260.44
LNAV	Nonprecision approach (lowest MDA = 250')	• WAAS NPA • GPS NPA • FMS based on GPS	Order 8260.38A

* The terminology that will be published on the approach plate is still under consideration.

A sample approach plate follows.

RNAV APPROACH PLATE



For WAAS operations, the WAAS equipment will support the best capability that is available. When entering the terminal area with an approach already selected, or when an approach is selected while in the terminal area, the WAAS equipment will inform the pilot of the level of service that is available. Automatic equipment will lock in that level of service. For the WAAS PA and LNAV/VNAV approaches, if the system fails to meet vertical requirements, the vertical guidance will be flagged as invalid and the pilot can continue to NPA minima. If the lateral guidance is flagged as invalid, GPS/WAAS cannot be used to continue the instrument approach.

The initial, intermediate, and missed approach segments will be RNAV procedures. Therefore, aircraft conducting these approaches must have RNAV capability.

Each approach chart may include a 5-digit identifier that provides a ready means of selecting the approach.

The vertical alert limit for the precision approach is 12 meters. For the LNAV/VNAV approach, the vertical alert limit is 20 meters.

2.2.3 Implementation Strategy

The FAA will develop RNAV instrument approach procedures for runway ends that currently have an instrument approach. New airports that comply with existing requirements for an instrument approach may also obtain an RNAV procedure.

Due to the coverage and availability limitations of the Phase 1 WAAS, RNAV procedures cannot be published everywhere in the NAS. RNAV procedures may be published at locations where:

a. the availability of LNAV/VNAV exceeds 95% (excluding outages of 15 minutes or less), and
b. the availability of WAAS PA exceeds 80% (excluding outages of 15 minutes or less).

Other locations will be considered individually based upon safety and operational advantages. Each approach chart will depict WAAS PA, LNAV/VNAV, and LNAV minima.

NOTAM service will provide the status of the WAAS for all known outages, whether scheduled or unscheduled. This information will be derived from information generated by the Service Volume Model (SVM). Therefore, a NOTAM for a WAAS approach at an airport will be generated using a model and may not reflect actual service coverage. IFR flight planning, dispatch and release will be based upon the LNAV minima: it cannot be based upon the WAAS PA or LNAV/VNAV approach minima. These approaches can be conducted if they are available upon arrival.

Any required alternate airport must have an approved instrument approach procedure other than GPS, RNAV, or Loran-C, that is anticipated to be operational at the estimated time of arrival.

3. READINESS EVALUATION STRATEGY

The WAAS Operational Readiness Evaluation strategy embodies three fundamental principles:

(1) Safety
(2) Functionality
(3) "Usability"

The strategy is to evaluate the WAAS Phase 1 readiness from an operational perspective with the following assumptions:

(1) The system will support departure, en route, and terminal navigation
(2) The system will provide the existing GPS nonprecision approaches
(3) The system will provide precision approaches at a limited number of airports

This strategy will provide the operational community with incremental benefits as the use of the system increases while maintaining adequate fallback capability to conventional navigation aids. In addition, this strategy will allow the Agency to conduct a comprehensive assessment of the WAAS prior to and after commissioning, thereby ensuring a smooth transition of the system into the NAS.

4. EVALUATION APPROACH AND CONCEPT

The WAAS Operational Readiness Evaluation will be directed and managed as a joint effort by the SOIT and GPS PT. In addition, organizations already performing flight test activities in support of GPS/WAAS NAS implementation will provide the additional assets required to complete the evaluation. Due to the accelerated commissioning schedule and the nature of the WAAS, the Operational Readiness Evaluation will be completed, in part, on a non-interference basis, in conjunction with the OT&E effort conducted by ACT-360.

Table 4-1 depicts the WAAS Operational Readiness Evaluation and OT&E responsibilities assigned to the SOIT, GPS PT, and ACT-360.

Table 4-1

OT&E (ACT-360)	OT&E AND OPERATIONAL READINESS EVALUATION (ACT-360, SOIT, GPS PT)
END TO END WAAS PERFORMANCE -INTEGRITY -ACCURACY -CONTINUITY -LATENCY -SERVICE VOLUME	FLIGHT STANDARDS OPERATIONAL PROCEDURES AND RESTRICTIONS
OPERATIONAL EFFECTIVENESS AND SUITABILITY	AIR TRAFFIC PROCEDURES AND METHODS OF PRACTICE
RELIABILITY AND MAINTAINABILITY	FLYABILITY IN NORMAL AND DEGRADED OPERATIONS UNDER ALL-WEATHER CONDITIONS
DEGRADED OPERATIONS AND OPERATIONAL UTILIZATION	DOCUMENTATION
	LOSS OF SIGNAL REPORTING PROCEDURES
HUMAN FACTORS	NOTAMS AND AERONAUTICAL INFORMATION

The WAAS Operational Readiness Evaluation will be conducted in three stages. The first stage will coincide with pre-Contract Acceptance Inspection (CAI) activity conducted under OT&E. The second stage will be conducted during the 90 days immediately following CAI and prior to system commissioning. The third stage will be a post-commissioning continuing assessment of the WAAS designed to allow the progressive removal of operational procedures and restrictions. The WAAS Operational Readiness Evaluation and OT&E will be conducted as two separate but coordinated activities so as to share limited resources and collected data on a non-interference basis.

OT&E will be conducted in accordance with the WAAS Commissioning Plan and the Operational Test and Evaluation Plan. The WAAS Operational Readiness Evaluation will be conducted in accordance with the WAAS Commissioning Plan, RTCA DO-229 (WAAS MOPS), and this Plan.

4.1 Critical Evaluation Areas

Critical areas that will be evaluated are defined as:

4.1.1 Flight Standards operational procedures and restrictions required for WAAS Phase 1 (see Appendix A)

4.1.2 Air Traffic operational procedures and methods of practice required for WAAS Phase 1 (see Appendix B)

4.1.3 WAAS Phase 1 operations (see Section 4.3, operational scenarios) under all-weather conditions to include:

4.1.3.1 Normal operations

-Flight Planning
-Departure
-En route
-Terminal area
-Precision approach
-Nonprecision approach
-Missed approach/divert

4.1.3.2 Degraded operations

-Flight Planning
-Departure
-En route
-Terminal area
-Precision approach
-Nonprecision approach
-Missed approach/divert

4.1.4 Operational "guidance" documentation required for WAAS Phase 1 (see Appendix C)

4.1.5 Loss of signal reporting (see Appendix D)

4.1.6 NOTAMS and aeronautical information(see Appendix E)

4.2 Operational Readiness Evaluation Criteria

The Phase 1 WAAS will be evaluated to assess its demonstrated accuracy, integrity, availability, and continuity. Aircraft using WAAS under Instrument Flight Rules (IFR) before Full Operational Capability (FOC) must be equipped with an approved and operational alternate means of navigation appropriate to the route of flight. The U. S. NAS is generally VOR-based. Some parts of the NAS (e.g., Alaska) may also rely on NDB. This means that,

for domestic operations in the NAS, aircraft must be equipped with VOR and/or ADF to support WAAS Phase 1 operations.

Evaluation forms to be used by evaluators to assess the readiness of the WAAS Phase 1 are found at Appendix F. The Operational Readiness Evaluation criteria to be applied to the critical evaluation areas identified in Section 4.1 above are as follows:

4.2.1 Flight Standards operational procedures and restrictions required for WAAS Phase 1 (see Appendix A).

Prior to WAAS commissioning, operational procedures and restrictions associated with WAAS Phase 1 usage must be in place to insure that users are aware of, and operate within, the availability and continuity constraints of the system. The development of these procedures/restrictions is the responsibility of Flight Standards.

The criteria for evaluation of operational procedures and restrictions are as follows:

a. Are they clear and understandable?

b. Do they conflict with existing regulations or guidance?

c. Do they promote the use of the system?

d. Do they enhance safety?

e. Do they conflict with current NAS operational procedures?

4.2.2 Air Traffic operational procedures and methods of practice required for WAAS Phase 1 (see Appendix B).

During Phase 1 WAAS, Air Traffic will be providing the maximum benefit to WAAS users. The Air Traffic SATNAV Implementation Office (ATO-402) will be responsible for the identification and development of WAAS Phase 1 specific procedures and methods of practice.

The criteria for evaluation of Air Traffic procedures and methods of practice are as follows:

a. Have WAAS handbook and procedural changes been implemented?

b. Are WAAS related handbook/procedures changes understood?

c. Were controllers trained on WAAS handbook and procedural changes?

d. Are WAAS system capabilities understood?

e. How does WAAS Phase 1 traffic interface with non-WAAS traffic?

4.2.3 WAAS Phase 1 operations (see Section 4.3, operational scenarios) under all-weather conditions to include normal and degraded operations during flight planning, departure, en route, terminal area, missed approach/divert and approach operations:

The criteria for evaluation of normal and degraded WAAS Phase 1 operations are as follows:

a. ***To be provided by Volpe***

4.2.4 Operational "guidance" documentation required for WAAS Phase 1 (see Appendix C)

The SOIT Pilot Proficiency Working Group will conduct a review of all pertinent FAA documentation to determine what documentation must be updated prior to WAAS commissioning. This will insure safe NAS operations and that all required documentation is available to the user community prior to commissioning. The required documentation is set forth in Appendix C.

The criteria for evaluation of required documentation is as follows:

a. Is it available?

b. Is the guidance clear and pertinent?

4.2.5 Loss of signal reporting procedures (see Appendix D)

Loss of signal reporting procedures will be developed by the SOIT Interference Reporting Working Group and are summarized in Appendix D. The criteria for evaluating loss of signal reporting procedures are as follows:

a. How will pilots and air traffic controllers/flight specialists recognize interference?

b. How will reports due to interference be differentiated from other reports of loss of signal?

c. How will reports of interference be processed by the receiving AT and AF personnel to the FAA Spectrum Office?

d. How will the FAA Spectrum Office respond to reports of interference?

4.2.6 NOTAMS and aeronautical information (see Appendix E)

WAAS Phase 1 NOTAM implementation and available aeronautical information will be developed by the ATSOIT and is outlined in Appendix E. The following criteria will be evaluated concerning the NOTAM system and aeronautical information:

a. Can the system handle an increase in traffic?

b. Does the system provide the correct information to users?

c. Does the current system provide information in a timely manner?

d. Is this information understandable?

4.3 Operational Scenarios

The operational scenario will be limited to two classes of aircraft in order to simplify data collection, analysis, and platform availability. The scenarios will be similar in profile but differ in length of flight and task loading. In as much as possible, evaluation flights will depart and arrive at designated evaluation locations.

4.3.1 The following minimum items will apply to both Air Carrier and General Aviation operations:

a. Flight planning – Prediction program(s), NOTAM availability, equipment listing, route acceptance

b. Departure/en route/terminal and approach operations - Capability to navigate safely, under Flight Standards established operational procedures and restrictions, in all phases of flight with WAAS Phase 1 equipment

c. Precision and nonprecision approach implementation - "T" approach procedures, approach availability

d. Missed approach/divert – Capability to comply

e. Loss of signal reporting - Recognition/response, report information/format, closed loop

f. Air Traffic procedures and methods of practice - Training, terminology.

4.3.2 For General Aviation only in addition to all the above:

a. Degraded operations - Loss of precision approach, loss of GEO, WAAS outage

b. Single pilot operations - Workload/situational awareness, training, terminology.

4.4 Readiness Evaluation Locations

The following locations have been selected for use in the readiness evaluation of the Phase 1 WAAS. The locations were selected based on identified OT&E sites, previously surveyed runways, and WAAS system performance criteria.

To be updated by Jim Snow

Atlantic City, NJ (OT&E)
Oklahoma City, OK (backup OT&E)
Anderson, SC (OT&E)
San Angelo, TX (OT&E)
Elko, NV (OT&E)
Prescott, AZ (OT&E)
Columbus, NE (OT&E)
Green Bay, WI (OT&E)
Greenwood, MS (OT&E)
Great Falls, MT (OT&E desired list)
Grand Forks, ND (OT&E desired list)
Dayton, OH (OT&E backup list)
Riverside, CA (OT&E additional list)
Seattle, WA (OT&E additional list)
Aracata, CA (OT&E additional list)
Denver, CO (OT&E additional list)
Bangor, ME (OT&E additional list)
Providence , RI
Richmond, VA
Holland, MI
Mcallen, TX
Aspen, CO
Fairbanks, AK
Juneau, AK
Honolulu, HI

4.5 Readiness Evaluation Platforms

4.5.1 Air Carrier:

a. NASA 757
b. ATA Heavy
c. FAATC 727

d. NavCanada Challenger
e. Lear 60

4.5.2 General Aviation:

a. NAWCAD Cheyenne II
b. F-18
c. Volpe Navajo
d. FAATC King Air
e. AFFSA C-21
f. NavCanada Citation
g. Cessna 182
h. OU Baron

4.6 Data Collection Platforms

The following platforms will be used to collect electronic data:

a. NASA 757
b. FAATC 727
c. NavCanada Challenger
d. AFFSA C-21
e. King Air
f. Cheyenne II
g. Lear 60.

4.7 Schedule

4.7.1 Pre-CAI - Activity during this stage will focus on participating, on a non-interference basis, with ACT-360 in the technical evaluation of WAAS performance, data collection, and analysis. This stage is currently scheduled to begin in mid-December, 1998 and be completed on or about March 16, 1999.

4.7.2 Post-CAI - Activity during this stage will focus on flight evaluation. A schedule will be developed for each platform to conduct all flight evaluations during this stage. This stage will begin April 1, 1999 and run through July 1, 1999.

4.7.3 Post-Commissioning - Activity will be as required to remove operational procedures and restrictions as the system matures.

4.7.4 A detailed schedule (see Appendix G) for the first two stages will be developed and coordinated with the SOIT, the Product Team, and those involved in the execution of this Plan. The schedule for the post-commissioning evaluation stage will be as required to remove

operational procedures and restrictions as the system matures. The schedule for the first two stages will be completed and coordinated no later than October 31, 1998 in order to insure platform and pilot availability.

5. ROLES AND RESPONSIBILITIES

5.1 Pre and Post-CAI

The WAAS Operational Readiness Evaluation will be directed and managed as a joint effort by the SOIT and GPS PT. The SOIT WAAS Commissioning Working Group is responsible for the execution and documentation associated with this Plan. Subsequent to pre-CAI stage and post-CAI stage execution and completion, the WAAS Commissioning Working Group will assess the results, reach a conclusion and prepare, for SOIT approval, a memorandum from the Chairperson(s), SOIT, to AVR-1, ATS-1, and ARA-1. The memorandum will report the results and conclusions of the Operational Readiness Evaluation and forward the SOIT recommendation regarding the commissioning of WAAS Phase 1.

5.2 Post-Commissioning

The SOIT WAAS Commissioning Working Group will be responsible for the post-Commissioning activity designed to continually assess WAAS operations with a view towards progressively removing operational procedures and restrictions and migrating the WAAS to the primary NAS navigation system.

5.3 Participating Organizations

Organizations actively participating in the execution of this Plan are the GPS PT, the SOIT, FAATC, NAWCAD, NavCanada, ACT-360, AFS-400, AIR-130, AT0-402, AOS-20, and AVN-5.

6. FUNDING

It is envisioned that participating organizations will provide the funding for the operations required in this Plan. Some travel funding may be required of the GPS PT.

APPENDIX A – FLIGHT STANDARDS OPERATIONAL PROCEDURES AND RESTRICTIONS

1. The WAAS Phase 1 will not provide the required availability and continuity of service to enable its unrestricted use in the NAS. The end-state WAAS (Phase E) has been designed to provide the requisite accuracy, integrity, availability, and continuity to allow its unrestricted use in the NAS.

2. The use of WAAS Phase 1 for VFR flight and the maintenance of situational awareness is unrestricted.

3. In order to allow the use of WAAS Phase 1 for IFR flight, certain operational procedures and restrictions must be enacted to ensure the safety of IFR operations.

4. Operators desiring to use the WAAS Phase 1 system for IFR flight within the NAS must comply with the following operational procedures and restrictions:

a. All GPS/WAAS NOTAMS and aeronautical information will be carefully checked.

b. Aircraft using WAAS under Instrument Flight Rules (IFR) before Full Operational Capability (FOC) must be equipped with an approved and operational alternate means of navigation appropriate to the route of flight. The U. S. NAS is generally VOR-based. Some parts of the NAS (e.g., Alaska) may also rely on NDB. This means that, for domestic operations in the NAS, aircraft must be equipped with VOR and/or ADF to support WAAS Phase 1 operations.

c. The initial, intermediate, and missed approach segments will be RNAV procedures. Therefore, aircraft conducting these approaches must have RNAV capability.

d. The destination approach will be flight planned to WAAS LNAV minima. The forecast weather must support a WAAS LNAV approach. If, on arrival at the destination airport, the WAAS equipment indicates the availability of an LNAV/VNAV or WAAS PA, the available approach may be executed.

e. For the WAAS PA and LNAV/VNAV approaches, if the system fails to meet vertical requirements, the vertical guidance will be flagged as invalid and the pilot can continue to NPA minima. If the lateral guidance is flagged as invalid, GPS/WAAS cannot be used to continue the instrument approach.

f. Any required alternate airport must have an approved instrument approach procedure other than GPS, RNAV, or Loran-C, that is anticipated to be operational at the estimated time of arrival.

APPENDIX B – AIR TRAFFIC PROCEDURES AND METHODS OF PRACTICE

1. The use of Phase I WAAS does not require Air Traffic to create any new procedures for aircraft entering the National Airspace System.

2. Required Air Traffic issues pertain to the modification of current operational procedures for controllers and flight service personnel including phraseology, and simultaneous independent and/or simultaneous parallel approaches. Document change proposals for FAA Orders have been implemented for publication prior to Phase I WAAS (Jul 99). Other required areas include: 1) WAAS equipment suffix, 2) WAAS approach procedures, 3) WAAS accuracy, availability, and integrity requirements; and, 4) WAAS anomalies.

3. Air Traffic Controller training is of paramount importance throughout the Phase I WAAS. Briefings on GPS began in 1994. A national initiative to provide familiarization and instruction is being established. Generalized training must be provided on a recurring basis and as needed to maintain controller proficiency in field facilities. During the Operational Readiness Evaluation, regions must identify more specific requirements needed to complete regional initiatives.

4. WAAS Monitoring: Air Traffic Control's requirement for a WAAS status monitor is not included as part of the Phase I WAAS.

APPENDIX C – OPERATIONAL GUIDANCE DOCUMENTATION

To be provided by Tom Glista/Pete Hwoschinsky

APPENDIX D – LOSS OF SIGNAL REPORTING

Pilots are required by the FARs to report to the controlling agency the malfunction of any navigation aid listed by the pilot in the flight plan. FAA controllers/flight specialists are required by FAA Order 7110.65 to request a report from a second aircraft to determine if it is affecting one, or more than one, aircraft. If the second aircraft confirms the malfunction, the controller will record the incident on FAA Form 7230-4, or appropriate Military Form, and notify appropriate Airway Facilities (AF) personnel. AF personnel will attempt to map the outage area to determine the extent of the outage and by coordinating with WAAS WRSs and WMSs determine if interference is indicated. If interference is suspected AF personnel will notify the Spectrum representative in that area who will initiate the interference reporting and investigation process.

When pilots receive information from on-board GPS receiver/FMS equipment that navigation by GPS is not permissible, action must be taken to assure aircraft separation is maintained and that the aircraft can safely transition to other navigation aids. If pilots are flying en route point-to-point off airways they must safely return to VOR/TACAN routing or be given radar vectors from controllers. IFR aircraft in the terminal area must transition to another navigation aid for completion of approach/departure or missed approach.

The following procedures will be validated during the Operations Readiness Evaluation. It should be possible to confirm all requirements through simulation using pilot and controller/flight specialist written procedures, checklists and verbal explanation:

1. Validate that procedures and training have been accomplished to insure that, when pilots report a GPS outage, the controller/flight specialist will request a report from a second aircraft in that area, report the results to AF and log the report on Form 7230-4.

Validation Process: Inspect documents for content, availability and currency and, inspect training records for personnel involved.

2. Validate that the above procedure will be carried out for the en route, approach, and terminal phases of flight i.e., at en route centers, TRACONs, RAPCONs, civil and military towers and Flight Service Stations.

Validation Process: Ask controller/flight specialists at each type of the above facilities to explain how transition will be accomplished. Inspect documentation and training records.

3. Verify how AT and AF will determine the cause of the pilot report. Ensure that AT and AF can identify interference as potential cause early in the process.

Validation Process: Provide a scenario to the participants and have them demonstrate their role in determining the cause of the incident. Ensure that effective coordination between the participants results in early identification of the root cause

4. Verify that the appropriate System Maintenance Office (SMO) and the Region Frequency Manager (FMO) are identified in the written procedures, are available on a 24 hour basis, and will be notified in a timely manner.

Validation Process: Trace the continuity of reporting functions from the pilot's initial report to the receipt of notification by the Region FMO. Ensure 24 hour communications capability with all players. Ensure current written procedures are available at all involved functional positions within the reporting chain.

APPENDIX E – NOTAMS AND AERONAUTICAL INFORMATION

The deployment of WAAS Phase 1 will require that the WAAS provide a means for the Air Traffic organization to issue a NOTAM when the WAAS Phase 1 is not available to the user for IFR operations. However, due to the limitations of storage capacity at Automated Flight Service Stations(AFSS), GPS/WAAS information will continue to be distributed as advisories until the automation systems at the AFSSs are upgraded (FY2000). NOTAM service will provide the status of the WAAS for all known outages, whether scheduled or unscheduled. This information will be derived from information generated by the Service Volume Model (SVM). Therefore, a NOTAM for a WAAS approach at an airport will be generated using a model and may not reflect actual service coverage. A Real-Time Service Model will be deployed with WAAS Phase II/III which will provide for immediate service coverage information from the WMS.

For WAAS Phase 1 the U.S. NOTAM Office (USNOF) will have the following information available from the WAAS Master Station (WMS) operator:

1. Outage information that will consist of only the phase of flight that is impacted. For example, precision approach, nonprecision approach, or en route. It is not necessary to inform the user of the particular WAAS component failure since a failure may or may not result in a loss of service.

2. Unscheduled outages that impact service will be forwarded to the USNOF within 15 minutes of occurrence.

3. Scheduled maintenance or predicted outage information impacting service, 15 minutes or longer in duration, must be forwarded to the USNOF at least 72 hours prior to the anticipated event.

4. Outage information will be sent electronically to the USNOF and will consist of an area description of the service impacted and a duration of the outage. Information will be submitted in ICAO format, which will be translated into domestic format for the near future.

NOTAM issues (to be tested)

1. Was WMS notification timely? e.g. 15 minute time frame
2. Was NOTAM distribution effective?
3. Was text readable?
4. Was information useable?
5. How does the NOTAM information compare with actual service availability?

Aeronautical information:

GPS RAIM information is distributed as advisory information through Automated Flight Service Stations (AFSSs).

APPENDIX F – EVALUATION FORMS

To be provided by Volpe

APPENDIX G - SCHEDULE

To be provided by Rich Cole